LIFT OFF!

Learn the real science behind the FUN!

Pokémon TRADING CARD GAME

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http://ksnn.larc.nasa.gov/pokemon

Purpose

To demonstrate how an airfoil creates lift. To understand Bernoulli's principle.

MATERIALS

Per Group
protractor
desk fan
wooden block (length of protractor)
50 cm stiff wire
bead
scissors
glue
tape
six 10-cm pieces of yarn
thin cardboard 11 cm X 31 cm
small nail
hammer
drill (optional)

Per Student
science journal

Procedure

1. Lay cardboard flat and measure 15 mm from one end of the cardboard and draw a line. Then measure 20 mm from the other end of the cardboard and draw a line. See diagram 1.
2. Fold the cardboard in half and fold the 15-mm edge of the cardboard so that it fits flat against the 24-mm edge. You should have a shape with a curved top (see diagram 2). This is an airfoil.
3. Lay the airfoil on its flat surface and make two holes through the center of the airfoil's widest part, one directly above the other. You may need adult help with this part.
4. Using tape, attach yarn to the airfoil as shown. See diagram 3.
5. Place the bead on one end of the stiff wire and loop or bend the wire so that the bead is secured to the end of the wire.
6. Guide the wire through the holes in the airfoil so that the curved side is on top and the flat side is on the bottom
7. Using a nail and hammer or drill, make a hole in the middle of the wooden block just big enough to hold the end of the wire.
8. Attach the protractor to the wooden block with either tape or glue. See diagram 4.
9. At a 70 degree angle, push the wire into the block so that it stands firmly (but not too firmly) so that the angle can be changed. See diagram 5.
10. On a flat surface, place the stand with the airfoil in front of the fan, making sure that the rounded edge of the airfoil is facing the fan. This edge is called the leading edge of the airfoil. The opposite edge is called the trailing edge. See diagram 6.
11. Turn the fan on low speed and observe. Record observations in your science journal.
12. Adjust wire to decrease angle to a 40-degree angle and repeat step 11.
13. Take the wire out of the wooden block and flip the airfoil over so that the flat side is on the top and the curved side is on the bottom. See diagram 7.
14. Repeat Steps 9-12 and record observations.

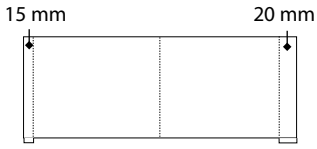

Diagram 1

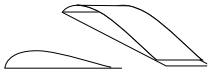
Diagram 2

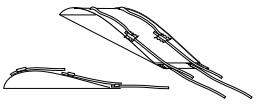
Diagram 3

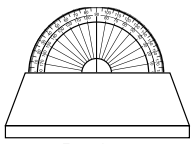

Diagram 4

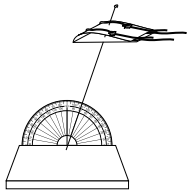
Diagram 5

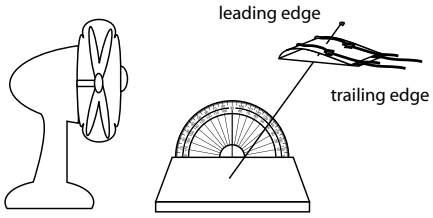

Diagram 6

Conclusion

1. What happened to the airfoil at a 70-degree angle?
2. What happened to the airfoil at a 40-degree angle?
3. Explain why there was a difference.
4. What happened when you flipped the airfoil over? Explain.
5. What conclusions can you draw from this experiment about the angle of a wing?

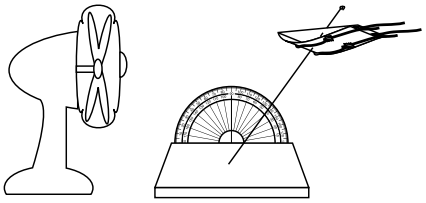
Diagram 7

Extensions

1. Experiment with various other angles.
2. Create other test objects to place on the wire.